Semester: VII		
ESTIMATION AND PROJECT MANAGEMENT (Theory and Practice)		
Course Code: MVJ21CV71		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours
Course Learning Objectives: The students will be able to		
1	Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project	
2	Understand and apply the concept of Valuation for Properties	
3	Understand, Apply and Create the Tender and Contract document.	

UNIT-I	
Quantity Estimation for Building: Study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method. **Estimate of R.C.C structures:** Slab, beam, column, footings, with bar bending schedule.	8 Hrs
UNIT-II	
Estimate of Structures: Steel truss, manhole and septic tanks. **Quantity Estimation for Roads:** Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling.	8Hrs
UNIT-III	
Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings. **Analysis of Rates :** Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.	8Hrs
UNIT-IV	
Contract Management-Tender and its Process: Invitation to tender, Pre-qualification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting. Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC	8Hrs
UNIT-V	
Contract Management-Post award : Basic understanding on definitions,	8Hrs

Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration **Valuation**: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation, valuation for mortgage, valuation of land.	

LABORATORY EXPERIMENTS

1. Case Study - Incorporating Pre-construction Cost Estimating in Construction Engineering and Management Programs
2. Case Study – Multiple Valuation Approaches Of Projects For Different Construction Designs & Techniques
3. Case Study-Construction Disputes
4. Building Contract Law-Indian Essays

Course Outcomes: After completing the course, the students will be able to	
CO1	Prepare detailed and abstract estimates for buildings & RC structures.
CO2	Prepare detailed and abstract estimates for roads and different structures.
CO3	Compute Specifications & Analyze the rates for different item of work.
CO4	Interpret Contract documents of domestic and international construction works
CO5	Prepare valuation reports of buildings.

Reference Books	
1.	"Estimating and costing", Datta B.N ,2016, UBSPD Publishing House, New Delhi ,ISBN: 9788174767707
2.	"Civil Engineering Contracts and Estimates", B.S. Patil, 7th Edition, Universities Press,Taylor & Francis Ltd,ISBN: 9780367133313
3.	" Estimating Construction Costs" Robert L Peurifoy , Garold D. Oberlender , 5th Edition , Tata McGraw-Hill , New Delhi
4.	PWD Data Book ,CPWD Schedule of Rates (SoR). and NH SoR – Karnataka MORTH Specification for Roads and Bridge Works – IRC New Delhi

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks

each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Mark

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	3	1	3	3	2	2	2
CO2	3	2	1	-	-	3	-	3	1	-	3	1
CO3	3	-	1	-	-	3	-	2	2	1	3	1
CO4	3	2	1	-	-	3	-	3	1	-	3	1
CO5	3	-	1	-	-	3	-	2	2	1	3	1

Semester: VII		
DESIGN OF PRE-STRESSED CONCRETE ELEMENTS (Theory)		
Course Code: MVJ21CV721		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs.
Course Learning Objectives: The students will be able to		
Course objective is to: This course will enable students to • Use the basics of prestressing to concrete elements. • Restate the basic principle of prestressing including losses. • Interpret the deflections in a prestressed concrete member. • Analyze the section for flexure, shear under limit state of serviceability and design the pre- stressed beam under permissible stress condition. • Describe the design of anchorage zones.		

UNIT-I	
Prerequisites: Concept of stress-strain characteristics of steel and concrete. Introduction- High strength concrete and steel, stress-strain characteristics and properties, fundamentals, load balancing concept, stress concept, center of thrust. Pre-tensioning and post- tensioning systems, tensioning methods, and end anchorages (Online mode). Laboratory Sessions/ Experimental learning: (Self Learning) • Experimental investigation to verify the efficiency and strength of post-tensioning systems. • Industrial visit to witness pre-tensioning and post-tensioning methods and different types of end anchorages. Applications: (Self Learning) • Understanding of principles of prestressing concept. • Find out the mechanism of the working of tensioning systems and various tools available to prestress the structures. Video link / Additional online information: (Self Learning) (Introduction to PSC, high strength concrete and steel, stress-strain characteristics and properties, pre- tensioning and post-tensioning systems, tensioning methods and end anchorages.) • https://nptel.ac.in/courses/105/106/105106117/	8 Hrs
UNIT-II	
Losses of Prestress: Stresses in concrete due to prestress and loads, stresses in steel due to loads, cable profiles, various losses encountered in pre-tensioning and post tensioning methods (Online Mode), determination of jacking force. Laboratory Sessions/ Experimental learning: (Self Learning) • Calculation of losses in a prestressed concrete beam. • FE software analysis to study the effect of cable profiles in	8 Hrs

determining the stress distribution in post-tensioned member. Applications: (Self Learning) • Estimating various losses of prestressing. • Find out the behaviour of prestressed concrete beam under different cable profiles. Video link / Additional online information: (Self Learning) (Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force.) • https://nptel.ac.in/courses/105/106/105106117/	
UNIT-III	
Deflection of a pre-stressed member – Short term and long-term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection. Laboratory Sessions/ Experimental learning: (Self Learning) • FE software analysis to study the effect of cable profiles in determining the deflections in post- tensioned member. Applications: (Self Learning) • Knowledge of deflection behavior of post-tensioned member under the loads and tendon profiles. • Understanding of long-term deformations due to creep in PSC. Video link / Additional online information: (Self Learning) (Short term and long-term deflections, elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343). • https://nptel.ac.in/courses/105/106/105106117/	8 Hrs
UNIT-IV	
Prerequisites: Knowledge of Limit State of Strength & Serviceability. **Flexure** -Types of flexural failure, IS Code recommendations (Online Mode). Ultimate flexural strength of sections. **Shear** - IS Code recommendations (Online Mode), shear resistance of sections, shear reinforcement. Limit state of serviceability – control of deflections and cracking. **Design of Beams**: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Laboratory Sessions/ Experimental learning: (Self Learning) • Analysis and design of simple prestressed concrete beams, encompassing bending and shear performance. • Comparative analysis of behavior of PSC and RCC sections under flexure and shear. Applications: (Self Learning) • Gives in depth knowledge of performance of PSC beams under flexure and shear. Video link / Additional online information: (Self Learning) (Types of flexural failure, IS code recommendations, ultimate flexural strength of sections, IS Code recommendations, shear resistance of	8 Hrs

sections, shear reinforcement, control of deflections and cracking. Design of Beams.) • https://nptel.ac.in/courses/105/106/105106117/	
UNIT-V	
Design of End block: Transmission of Prestress in pretension members, transmission length, Anchorage stress in post-tensioned members (Online Mode). Bearing stress and bursting tensile force stresses in end blocks- Methods, I.S. code provision for the design of end block reinforcement. Laboratory Sessions/ Experimental learning: (Self Learning) • Software analysis of stress in anchorage zone in post-tensioned members. • Case study on the effect of reinforcement on anchorage zone cracks in prestressed concrete members. Applications: (Self Learning) • Learn design of end zone reinforcement to check the bursting effect of the tensile stresses. Video link / Additional online information: (Self Learning) (Transmission of Prestress, Bearing stress and design of end block reinforcement). • https://nptel.ac.in/courses/105/106/105106117/	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the basic concept of pre-stressing and understand the requirement of PSC members for present scenario.
CO2	Examine the stresses encountered in PSC element during transfer and at working.
CO3	Interpret the effectiveness of the design of PSC after studying losses.
CO4	Investigating the PSC element and finding its efficiency and design PSC beam for different requirements.
CO5	Design the end blocks in PSC using codal provisions.

Reference Books	
1.	Prestressed Concrete- N. Krishna Raju - Tata McGraw Hill Publishers- Sixth Edition, 2018.
2.	Pre-stressed Concrete- N. Rajagopalan- Narosa Publishing House- Second Edition, 2015.
3.	Pre-stressed Concrete structures- P. Dayaratnam- Medtech Publishers- Seventh Edition, 2017.
4.	K U Muthu - "Prestressed Concrete"- PHI Learning, 2016.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50

marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	1	2	-	1	-	-	-	-	-	-	-	1
CO3	1	2	-	2	-	-	-	-	-	-	-	1
CO4	1	2	2	2	-	-	-	-	-	-	-	1
CO5	1	2	3	2	-	-	-	-	-	-	-	1

Semester: VII		
DESIGN OF HYDRAULIC STRUCTURES (Theory)		
Course Code: MVJ21CV722		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 03 Hrs.

Course Learning Objectives: The students will be able to	
1	Analyze and design gravity dams.
2	Find the cross-section of earth dam and estimate the seepage loss.
3	Design spillways and aprons for diversion works.
4	Design CD works and chose appropriate canal regulation works.

UNIT-I	
Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.	8 Hrs
UNIT-II	
Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.	8 Hrs
UNIT-III	
Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices. Diversion Headworks: Design of aprons- Bligh's and Koshla's theory, Simple Problems.	8 Hrs
UNIT-IV	
Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.	8 Hrs
UNIT-V	
Canal Regulation Works: Introduction, Function of a regulator. Canal falls: Necessity and types. Canal outlets: Necessity and types.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Check the stability of gravity dams and design the dam.
CO2	Estimate the quantity of seepage through earth dams.
CO3	Detail the Spillway analysis and design of apron
CO4	Design spillways and aprons for various diversion works.
CO5	Select particular type of canal regulation work for canal network

Reference Books	
1.	S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2.	Punmia and Pandey Lal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3.	K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard Publications, New Delhi.

4.	R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, New Delhi.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	1	-	1	1	-	1
CO2	2	2	1	2	-	1	1	-	-	1	1	1
CO3	2	1	1	1	-	1	-	-	1	1	-	1
CO4	2	1	1	1	-	1	-	-	1	1	-	1
CO5	2	1	1	2	-	1	1	-	1	1	-	1

Semester: VII		
SOLID WASTE MANAGEMENT (Theory)		
Course Code: MVJ21CV723		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to		
1	Restate the different elements of solid waste management from generation of solid waste to disposal.	
2	Analyze different processing technologies.	
3	Evaluate landfill site and conversion of municipal solid waste to compost or biogas.	
4	Identify sources, collection, treatment, and disposal of various types of solid waste.	
5	Analyze the energy recovery techniques from solid waste.	

UNIT-I	
Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. functional elements of solid waste management system Generation rate, Numerical Problems. **Collection**: Collection of solid waste- services and systems, equipment's. **Transportation**: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with 2016 amendments. Laboratory Sessions: • Poster Presentation on composition of Solid waste • Collection of solid waste generation data of the campus Applications: (Self Learning) • Identification of various sources, collection and transportation of solid waste. • Effects of mishandling of solid waste on human beings and environment. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	8 Hrs
UNIT-II	
Processing techniques: Purpose of processing, Chemical volume reduction (incineration) - Process description, 3T's, principal components in the design of municipal	8 Hrs

incinerators, Air pollution control, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods). Laboratory Sessions: • Poster Presentation on Processing of Municipal Solid Waste Applications: (Self Learning) • Identification of different processing techniques of Solid waste. • Identification of factors responsible for the design of Incinerators. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	
UNIT-III	
Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems. **Sanitary Landfilling**: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems. Laboratory Sessions: • Poster Presentation on Design of Sanitary Landfills. • Checklist for Composting techniques. Applications: (Self Learning) • Identification of factors responsible for site selection for a Sanitary Landfill. • Effects of mishandling Sanitary Landfill Site. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	8 Hrs
UNIT-IV	
Sources, collection, treatment and disposal of :Biomedical waste, E-waste, Hazardous waste and Construction and Demolition waste Laboratory Sessions: • Collection of E-waste generation data of the campus.	8 Hrs

• Poster Presentation on collection, transport, and processing of Construction waste. Applications: (Self Learning) • Segregation of Biomedical waste and its impact on Biomedical waste handling and processing. • Identification of characteristics of Hazardous waste. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	
UNIT-V	
Waste management rules and its amendments- Plastic Waste, E-waste, Biomedical Waste and Hazardous Waste. Energy recovery technique from solid waste management Laboratory Sessions: • Poster Presentation on Energy recovery techniques from solid waste management Applications: (Self Learning) • Different energy recovery techniques and their implications. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate different elements of solid waste management system
CO2	Design suitable processing system
CO3	Asses the disposal site for solid waste
CO4	Identify sources, collection, treatment, and disposal of various types of solid waste
CO5	Apply the energy recovery techniques utilizing solid waste

Reference Books	
1.	George Tchobanoglous, Hilary Theisen , Samuel A Vigil, “Integrated Solid Waste Management: Engineering principles and management issues”, M/c Graw hill Education . Indian edition, 1993.
2.	Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co ltd, ISBN: 9789351340263, 9789351340263, 2017
3.	Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of

	Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016.
4.	Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	1	1	2	-	-	-	1
CO2	2	2	1	-	-	1	-	-	-	-	-	-
CO3	2	2	-	-	-	1	-	-	-	-	-	-
CO4	2	2	-	-	-	1	1	2	-	-	-	-
CO5	2	2	-	-	-	1	1	2	-	-	-	1

Semester: VII			
OPEN CHANNEL HYDRAULICS (Theory)			
Course Code: MVJ21CV724			CIE Marks: 50
Credits: L:T:P: 3:0:0			SEE Marks: 50
Hours: 40L			SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to			
1	State the Principles of dimensional analysis and design hydraulic models.		
2	Design of open channels of different cross sections through concept of economical sections.		
3	Develop Water surface profiles at different bed slope condition using Energy concepts of fluid in open channel.		
4	Make student to Explain on working principles of the hydraulic machines and analyzing the performance of turbines under design condition.		
5	Gain the knowledge on working principles of Pumps		

UNIT-I	
Basic Flow Concepts: Types of channels, classification of flows, basic equations, velocity distribution, velocity coefficients, pressure distribution. Energy and momentum principles: Specific energy, critical flow, section factor for critical flow computation, first hydraulic exponent, computation of critical flow, specific force, specific force, channel transitions.	8 Hrs
UNIT-II	
Open Channel Flow Hydraulics (Uniform Flow): Introduction, Classification of flow through channels (Online Mode), Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Uniform flow in mobile boundary channels: Incipient motion condition, shield's analysis, regimes of flow, prediction of regimes, flow resistance. Laboratory Sessions/ Experimental learning: (Self Learning) • Determination of Metacentric height to check the stability of partially submerged boat • Formulation of Excel Sheet program for Chezy's and Manning's method Applications: (Self Learning) • Stability Analysis of Submarine • Arrive the optimum weight of Hot-Air Balloon • Measure Relative density by Hydrometer Video link / Additional online information: (Self Learning) • Buoyancy, Metacenter, Stability and Rigid body motion:	8 Hrs

https://nptel.ac.in/courses/ 105103192/ • Open Channel Flow: https://nptel.ac.in/courses/105107059/	
UNIT-III	
Open Channel Flow Hydraulics (Non-Uniform Flow): Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes (Online Mode), Numerical Problems. Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems. Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems. Laboratory Sessions/ Experimental learning: (Self Learning) • Computation of Gradually Varied Flow profiles for a given slope pattern • Model Making of Hydraulic Jump under different Froude Number • Calculation of Critical depth and energy using Excel sheet Applications: (Self Learning) • Flow Measuring into a reservoir • Hydraulic Critical Zones Video link / Additional online information: (Self Learning) • Open Channel Flow: https://nptel.ac.in/courses/105107059/ • Free Surface flow: https://nptel.ac.in/courses/105106114/	8 Hrs
UNIT-IV	
Design of channels: Rigid boundary channels, non-scouring channels, alluvial channels. **Rapidly varied flow**: Flow over sharp crested weir, spillways, flow under sluice gate.	8 Hrs
UNIT-V	
Unsteady flow: Waves, celerity of small gravity wave, St. Venant's equation, surges in open channels.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Create mathematical model of hydraulics variables using dimensional analysis
CO2	Analyze the relationship between dependent and independent model parameters
CO3	Apply the Energy concepts to compute the flow in open channel sections
CO4	Draw the water surface profiles at different bed slope conditions
CO5	Design turbines for the given data with their operation characteristics

Reference Books	
1.	P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic

	Machines", 20th edition, 2015, Standard Book House, New Delhi.
2.	R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2010
3.	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill,New Delhi. 2006
4.	J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company.- 2009.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	1	-	1	1	-	1
CO2	2	2	1	2	-	1	1	-	-	1	1	1
CO3	2	1	1	1	-	1	-	-	1	1	-	1
CO4	2	1	1	2	-	1	1	-	1	1	-	1
CO5	2	1	1	2	-	1	1	-	-	1	1	1

Semester: VII		
PAVEMENT DESIGN (Theory)		
Course Code: MVJ21CV731		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2	Excel in the path of analysis of stress, strain and deflection in pavement.
3	Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4	Understand the various causes leading to failure of pavement and remedies for the same.
5	Develop skills to perform functional and structural evaluation of pavement by suitable methods.

UNIT-I	
Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.	8 Hrs
UNIT-II	
Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above. Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.	8 Hrs
UNIT-III	
Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for Airfield pavement and problems on above.	8 Hrs
UNIT-IV	
Stresses in Rigid Pavement : Types of stress, Analysis of Stresses,	8 Hrs

Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above. Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.	
UNIT-V	
Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Systematically generate and compile required data's for design of pavement (Highway & Airfield).
CO2	Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
CO3	Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
CO4	Evaluate the performance of the pavement.
CO5	Develop maintenance statement based on site specific requirements

Reference Books	
1.	S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2.	L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3.	Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.
4.	Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	-	2	-	-	-
CO3	2	2	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	2	1	-	-
CO5	2	2	2	-	-	-	-	-	2	1	-	-

Semester: III		
ADVANCED FOUNDATION ENGINEERING (Theory)		
Course Code: MVJ21CV732		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to		
1	Discuss the knowledge in calculating the bearing capacity and settlement of soils ·	
2	Examine the advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course	
3	Illustrate profound understanding of shallow and deep foundation analyses	
4	Classify the choice of foundation design parameters	
5	Relate the cause and effect of dynamic loads on foundation	

UNIT-I	
Prerequisites: basic geotechnical engineering, advanced geotechnical engineering, soil mechanics General bearing capacity equation-Terzaghi's, Brinch Hansen's and Meyerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. (Online mode) Principles of design of footing, Proportioning of footings for equal settlement. Laboratory Sessions/ Experimental learning: (Self Learning) • Standard penetration test • Dynamic cone penetration test • Vane shear test Applications: (Self Learning) • Model making of footings • Case study of settlement of foundation	8 Hrs
UNIT-II	
Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation (online mode), Design of raft foundation-Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS- 2950) procedure. Laboratory Sessions/ Experimental learning: (Self Learning) • Design of raft foundation using software Applications: (Self Learning) • Introduction to Ansys software	8 Hrs

UNIT-III	
Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles. Laboratory Sessions/ Experimental learning: (Self Learning) • Model making of pile foundation Applications: (Self Learning) • Case studies related to pile foundation in clay and sand	8 Hrs
UNIT-IV	
Well Foundations: Introduction, Different shapes, and characteristics of wells. Components of well foundation (online mode), Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts. Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic, and floating caissons. Advantages and disadvantages of floating caissons. Laboratory Sessions/ Experimental learning: (Self Learning) • Poster preparation of well foundation and caissons Applications: (Self Learning) • Case studies related mitigation to sinking of well foundation	8 Hrs
UNIT-V	
Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, (online mode), general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control. Laboratory Sessions/ Experimental learning: (Self Learning) • Poster preparation of machine foundation • Vibration analysis of a machine foundation Applications: (Self Learning) • Case studies related to vibration isolation and control .	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Find the settlement and bearing capacity of soil
CO2	Describe the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
CO3	Identify the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles
CO4	Recall the basics of analysis and design principles of well foundation, drilled piers and caissons

CO5	Use the design principles of machine foundations program

Reference Books	
1.	Punmia B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Co., India
2.	Murthy V.N.S., Advanced Foundation Engineering, CBS PUBLISHERS
3.	Donald P. Coduto, Geotechnical Engineering Principles & Practices, Prenticehall of India Ltd, India
4.	Bowles J.E., Foundation Analysis and Design, McGraw Hill Pub. Co. New York

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	-	2	-	-	-
CO3	2	2	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	2	1	-	-
CO5	2	2	2	2	-	-	-	-	2	1	-	-

Semester: VII			
CONSTRUCTION METHODS, PLANNING AND MANAGEMENT (Theory)			
Course Code: MVJ21CV733			CIE Marks: 50
Credits: L:T:P: 3:0:0			SEE Marks: 50
Hours: 40L			SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to			
1	Discuss project preparation, Planning and Analysis with its types, measures & tools for assessment.		
2	Illustrate various management techniques for successful completion of construction projects.		
3	Classify various types of equipment's used in construction projects.		
4	Explain the various safety concepts and requirements applied to construction projects.		
5	Examine materials management technique in construction		

UNIT-I	
Prerequisites: Building materials, Construction management **Project Planning:** Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. (Online mode). Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data. Application of MS-Project and Primavera for planning Laboratory Sessions/ Experimental learning: (Self Learning) • Scheduling a residential building with G+1 project using MS-Project • Scheduling a residential building with G+1 project using Primavera Software Applications: (Self Learning) • Knowledge about MS-Project and Primavera software • Able to access the real time project scheduling and planning Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/ • https://nptel.ac.in/courses/105/103/105103093/	8 Hrs
UNIT-II	
Scheduling Procedures- Construction Scheduling, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. **Project Controlling-** Monitoring and Control, Crashing (Online mode), Resource Leveling, Updating. Laboratory Sessions/ Experimental learning: (Self Learning) • Resource allocation and management using Primavera Software Applications: (Self Learning)	8 Hrs

• Knowledge about the network analysis • Identifying different methods of scheduling a project Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/102/105102199/	
UNIT-III	
Construction Equipment's and Management- Identification, Planning of equipment, Selection of Equipment, Equipment Management in Projects, Maintenance Management,(Online Mode). Equipment cost, Operating cost, Cost Control of Equipment, Depreciation Analysis, Replacement of Equipment, Replacement Analysis , Safety Management **Equipment for Earthwork**- Fundamentals of Earth Work Operations, Earth Moving Operations, Types of Earth Work Equipment- Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment (Online Mode) Laboratory Sessions/ Experimental learning: (Self Learning) • Case study on selection of construction equipment Applications: (Self Learning) • Behavior of different types of equipment used in construction • Knowledge about planning and selection of equipment in construction projects Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/103/105103206/	8 Hrs
UNIT-IV	
Construction Quality, Safety and Human Values- Quality and Safety Concerns in Construction - Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management (Online Mode). **HSE**- Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms /ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. **Ethics**- Morals, values and ethics, need of engineering ethics. (Online Mode). Laboratory Sessions/ Experimental learning: (Self Learning) • Case study on construction safety • Poster preparation on construction safety Applications: (Self Learning) • Understanding the quality and safety concerns in construction • Knowledge about total quality management measures taken in construction Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/110/105/110105094/	8 Hrs

UNIT-V	
Labor and Material Utilization- Historical Perspective, class of labour, Wages & statutory requirement, (Online Mode). Labor Productivity, Factors Affecting Job-Site Productivity, Labour Relations in Construction, Problems in Collective Bargaining, **Materials Management** - Material Procurement and Delivery, Inventory Control, Trade-offs of Costs in Materials Management Laboratory Sessions/ Experimental learning: (Self Learning) • Sample preparation of checklist for material procurement Applications: (Self Learning) • Knowledge in latest skills for managing supply chain, logistics, delivery, storage of materials and impart training for improving output Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106206	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Use relevant software packages for planning, scheduling, executing and controlling of construction projects.
CO2	Predict the total time required to complete the job without delay and delay in the project
CO3	Classify the type and capacity of construction equipment used in construction site.
CO4	Illustrate safety manuals and practice safety in construction operations
CO5	Examine the modern trends in project management

Reference Books	
1.	Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2.	Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
3.	Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 1997
4.	Calin M. Popescu, Chotchai Charoenngam, "Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications", Wiley, New York, 1995.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods

for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12
CO1	3	2			2				2	1		
CO2	2	3		1	1	1						
CO3	3	2	1						1	1		
CO4	2	1	1	1		2		1		1		
CO5	3	2			1		1		1	1		

Semester: VII		
GROUND IMPROVEMENT TECHNIQUES (Theory)		
Course Code: MVJ21CV734		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to		
• State the engineering behavior of natural soils & various methods adopted for Evaluation of soil conditions • Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification by adopting Mechanical and Geo-synthesis methods for construction of civil engineering structures • Explain the techniques and methods adopted for dewatering and grouting methods • Apply the knowledge on stabilization of soils. • Illustrate the various reinforcement techniques adopted for stabilization of soils.		

UNIT-I	
Rock cycle: classification of rocks and rocks forming minerals; Weathering process and formation of soil; Role of ground improvement in foundation Engineering; Methods of Ground improvement – Geotechnical Problems in alluvial, lateritic, and black cotton soils. Selection of Suitable ground improvement techniques based on soil conditions- In situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications Laboratory Sessions: • Identification of various soils and their characteristics Applications: • Study on physical and chemical characteristics of various soils • Based upon the soil nature, find out the suitable method adopted for stabilization of soils	8 Hrs
UNIT-II	
Mechanical Modification – Principles of soil densification – Properties of Compacted soil, Compaction control tests, Specification of compaction requirements, Blasting, Vibro-compaction, Dynamic Tamping and Compaction piles. **Geo-synthetics** – Types - general applications - types of geotextiles and geo-grids - physical and strength properties of geotextiles and geo-grids - behavior of soils on reinforcing with geotextiles and geo-grids - design aspects with geotextiles and geo-grid. Laboratory Sessions: • Analyzing the various mechanical methods adopted for various	8 Hrs

types of soil Applications: • Understand the various mechanical instruments used for stabilization • Type and method adopted for stabilization of soils Video link / Additional online information: • Water resource system : https://nptel.ac.in/courses/105108130	
UNIT-III	
Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geo-synthetics, Preloading and vertical drains, Electro-kinetic dewatering, capacity of pumps and pumps design, installation and operation of dewatering systems – single line, two-line, flow to a single well, multiple well systems **Grouting**: Introduction, effect on properties of soils, Grouting – types - desirable characteristics of grouts, grouting methods - grouting pressure - grouting materials - grouting technology; - permeation grouting - compaction grouting - soil fracture grouting - jet grouting - application and limitations - slab jacking, grouted columns - application to dams. Laboratory Sessions: • Identification of dewatering and grouting methods for stabilization of soils Applications: • Decision making for selection of suitable pumping methods • Grouting methods adopted for Dam, Reservoir and tunnel construction	8 Hrs
UNIT-IV	
Stabilization of soils: Mechanical Stabilization -Soil aggregate mixtures, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control; Cement Stabilization- Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques; Lime and Bituminous Stabilization-Type of admixtures, mechanism, factors affecting, design of mixtures, construction methods Laboratory Sessions: • Verification of suitable chemical methods for stabilization of soils. Applications: • Justification of suitable additives used for chemical stabilization • Evaluation of effective utilization of chemicals in the soil stabilization	8 Hrs
UNIT-V	
Soil improvement by using Reinforcing Elements - Introduction to	8 Hrs

Reinforced Earth - Load Transfer Mechanism and Strength Development - Soil Types - Reinforcing Materials - Reinforced Earth Retaining walls - Reinforced Embankments - Soil Nailing. Ground Improvement Techniques for Geotechnical Earthquake Engineering, Case studies on ground improvement techniques Laboratory Sessions: • Design the suitable method of Reinforcement. Applications: • Stabilization of soil by adopting of various reinforcement techniques • Evaluation of Ground improvement techniques in Seismic Hazard zones	

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the natural processes involved in the formation of soil as well as find out the suitable method for stabilization of soils.
CO2	Address the mechanical modifications and geo-synthesis effects on soil
CO3	Implement the various dewatering methods and grouting methods
CO4	Analysis the various chemical methods adopted for Stabilization of soils
CO5	Select the suitable method for stabilization of soil by Reinforcement techniques.

Reference Books	
1.	Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2.	Manfred Hausmann , "Engineering principles of ground modification", Mc Graw Hill Pub. Co.
3.	Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London
4.	Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
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CO3	1	1	2	2	-	-	-	-	1	-	1	1
CO4	1	1	2	2	1	-	-	-	1	-	1	1
CO5	1	1	2	2	1	-	-	-	1	-	1	1

Semester: VII		
ENVIRONMENTAL IMPACT ASSESSMENT (Theory)		
Course Code: MVJ21CV741		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs.
Course Learning Objectives: The students will be able to		
Course objective is to: This course will enable students to • To identify the major challenges in environmental issues and evaluate possible solutions. • Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development. • To analyze an overall impact of specific issues and develop environmental management plan.		

UNIT-I	
Introduction: Environment – Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation Environmental Impact Assessment, Sustainable Development.	8 Hrs
UNIT-II	
Natural Resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle. Energy – Different types of energy, Conventional sources & Non Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	8 Hrs
UNIT-III	
Environmental Pollution – Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.	8 Hrs
UNIT-IV	
Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods.	8 Hrs
UNIT-V	
Introduction to GIS & Remote sensing, Applications of GIS & Remote Sensing in Environmental Engineering Practices. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs), Environmental Education & Women Education.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues

Reference Books	
1.	Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited
2.	R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.
3.	Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005
4.	P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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CO1	1		1	3	1		1		1	1		
CO2	2	2	3	3	1							
CO3	3	2	3	3		1		1	2		1	
CO4	1	2	3	3								
CO5	1		1	3	1		1		1	1		

Semester: VII		
REMOTE SENSING AND GIS (Theory)		
Course Code: MVJ21CV742		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	State the basic concepts of Remote Sensing.
2	Identify the various Remote Sensing Platforms and its limitations
3	Illustrate various international space programs
4	Brief various Geographical Information System (GIS) method
5	Solve real time problem by the application of RS & GIS

UNIT-I	
Introduction to Remote Sensing: **Introduction:** Introduction to Remote Sensing: Definition - History & Concepts - Electromagnetic Radiation (Source, Mode of Energy transfer, Radiation Principles, Black body radiation); Electro Magnetic Radiation (EMR): EMR Spectrum - EMR Interaction with Atmosphere (Absorption, Scattering & Atmospheric windows) - EMR Interaction with Earth surface (Absorption & reflection) - Spectral Response pattern - Energy budgeting in Remote Sensing.	8 Hrs
UNIT-II	
Sensor and its characteristics: **Sensors and Platforms:** Resolutions (Spectral, Spatial, Temporal, Radiometric) –Platforms Sensors - Scanning & Orbiting Mechanism of Satellites and Data Acquisition. Optical Remote Sensing: Basic concepts -Optical sensors and scanners. **Thermal & Microwave Remote Sensing**: Thermal Remote Sensing: Basic concepts-Thermal sensors & scanners - Thermal Inertia. Microwave Remote Sensing: Basic concepts Microwave sensors and Radiometers - Geometric characters – Radar grammetry (SLAR/SAR)-LIDAR -Hyper spectral Remote Sensing: basic concepts.	8 Hrs
UNIT-III	
Remote Sensing Satellite Programme: Remote Sensing Satellites: LANDSAT Series - IRS Series - IRS-P series - Cartosat - Spot Series - ASTER, MODIS - IKONOS - QUICKBIRD - ORBVIEW -ERS - Meteorological Satellites -Shuttle Mission - Developments of Remote Sensing in India - Future Remote Sensing Missions	8 Hrs
UNIT-IV	
Introduction to Geographical Information System (GIS): Definition - Usefulness of GIS - Components of GIS - Computer Hardware, Software Modules and Organizational Context of GIS. **Data Structure:**	8 Hrs

Data Structure in GIS - Types of Data (Points, Lines and Polygons) - Data Base Structures (Raster Data Structures and Vector data Structures) - Data Conversion (Vector to Raster and Raster to Vector)	
UNIT-V	
Integrated Applications of Remote sensing and GIS: Applications in Land use Land cover analysis, change detection, Water Resources, Urban Planning, Environmental Planning, Natural Resource Management and Traffic Management. Location Based Services and its Applications.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Collect data and delineate various elements from the satellite imagery using their spectral signature
CO2	Identified various Remote Sensing Platforms and its limitations
CO3	Restate and apply sustainability concepts in various space programmes
CO4	Analyze different features of ground information to create raster or vector data.
CO5	Perform digital classification and create different thematic maps for solving specific problems & Make decision based on the GIS analysis on thematic maps.

Reference Books	
1.	Anji Reddy M., "Remote sensing and Geographical information system", B.S. Publications 2008
2.	S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005
3.	Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006
4.	John R. Jensen, "Remote sensing of the environment" , An earth resources perspective – 2nd dition – by Pearson Education 2007

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	3	-	-	-	-	1	-	1	1
CO2	2	1	2	1	-	-	-	-	1	-	1	1
CO3	2	1	2	1	-	-	1	-	1	-	1	1
CO4	2	1	2	1	-	-	-	-	1	-	1	1
CO5	2	1	2	1	-	-	1	-	1	-	1	1

Semester: VII		
INDUSTRIAL POLLUTION & PREVENTION (Theory)		
Course Code: MVJ21CV743		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to		
To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control		

UNIT-I	
Industrial wastes and their sources: Various industrial processes, Sources, and types of solid, liquid, gaseous wastes, Noise & radiation emissions. Sources of industrial water usages and various industrial processes requiring water use and required water quality.	8 Hrs
UNIT-II	
Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial waste waters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radio activity etc. Waste water reuse & recycling, Concept of zero discharge effluent.	8 Hrs
UNIT-III	
Control of gaseous missions: Hood and ducts, Tall stacks, Particulate and gaseous pollutant control, Solid waste generation and disposal management. Hazardous wastes: Definitions, concepts and management aspects. Noise & radiation: Generation, control and management.	8 Hrs
UNIT-IV	
Recent trends in industrial waste management, Cradle to grave concept, Life cycle analysis, Clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.	8 Hrs
UNIT-V	
Environmental audit: Definition and concepts, Environmental audit versus accounts audit, Compliance audit, Relevant methodologies, Various pollution regulations, Introduction to ISO and ISO14000.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify industrial sources of pollution.
CO2	Identify cause of deterioration of water
CO3	Outline and use the control techniques for the particulate and gaseous emissions.
CO4	Outline degree of treatment and type of treatment for disposal, reuse and recycle.
CO5	Assess compliance with regulatory requirement.

Reference Books	
1.	Shen T.T., "Industrial Pollution Prevention", Springer, 1999.
2.	Stephenson R.L. and Blackburn J.B., Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New York, 1998
3.	Freeman H.M., "Industrial Pollution Prevention Hand Book", McGraw Hill Inc., New Delhi, 1995.
4.	Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw Hill, 2000

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	-	-	-	1	-	-	-	-
CO2	2	-	1	3	2	-	-	1	-	-	-	-
CO3	3	-	-	1	1	-	1	1	-	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	-
CO5	-	-	-	-	-	-	-	1	-	-	-	-

Semester: VII		
PROJECT PHASE-I (Theory)		
Course Code: MVJ21CVP75		CIE Marks: 50
Credits: L:T:P: 0:0:2		SEE Marks: 50
Hours:		SEE Duration: 03 Hrs.

Course Learning Objectives: The students will be able

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - I: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and use modern tools and techniques
CO2	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO3	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.

Reference Books	
1.	Shen T.T., "Industrial Pollution Prevention", Springer, 1999.
2.	Stephenson R.L. and Blackburn J.B., Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New York, 1998
3.	Freeman H.M., "Industrial Pollution Prevention Hand Book", McGraw Hill Inc., New Delhi, 1995.
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CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2